FOLD IN FLOOR SEAT ASSEMBLY HAVING RETRACTING FRONT LEG LINKAGE ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The invention relates to a seat assembly for an automotive vehicle having a seat cushion and seat back which are selectively movable between a seating position and a stowed position. More particularly, the invention relates to a seat assembly having a pair of front legs for supporting the seat cushion and a linkage assembly for retracting the front legs in response to movement of the seat assembly from the seating to stowed position.

2. Description of the Related Art

[0002] Automotive vehicles include seat assemblies for supporting occupants above a floor in the vehicle. Seat assemblies include a seat cushion and a seat back. Typically, the seat cushion is coupled to the vehicle floor by front and rear legs. The front and rear legs are attached to striker assemblies mounted in the floor for selective attachment to the vehicle floor. It is known that such seat assemblies may be forwardly or rearwardly stowed in recesses in the floor of the vehicle in response to actions performed by an occupant of the vehicle.

[0003] For rear seats, it is widely known to provide riser assemblies between the seat cushion and the floor of the vehicle to allow selective tumbling of the seat between a generally horizontal seating position, an upright folded position, and a stowed position within a recess formed in the floor of the vehicle. The front legs of such rear seat assemblies need to be retracted prior to stowing of the seat within the recess in the floor of the vehicle. The retraction system should be robust and allow for repeated movement of the front legs between a seated position for supporting the seat cushion in the horizontal seating position and a

retracted position recessed against the bottom of the seat cushion. The retraction system should accommodate movement of the front legs between the retracted position and the seating position when stowed by an occupant without failure of the retraction system.

[0004] There is, therefore, a need in the art for a front leg retraction system that is reliable and will accommodate movement of the front legs between retracted and seating positions without failure of the retraction system.

SUMMARY OF THE INVENTION

[0005] According to one aspect of the invention, a seat assembly is provided for pivotal movement between a seating position secured to a floor of a motor vehicle and a stowed position recessed with the floor of the vehicle. The seat assembly comprises a seat cushion, a pair of front legs each having a first end pivotally attached to the seat cushion and a second end adapted to be removably attached to a striker assembly in a floor of the vehicle, and a pair of rear legs each having a first end attached to the seat cushion and a second end adapted to be pivotally attached to the floor. A linkage assembly is coupled between the front legs and the rear legs for selectively controlling movement of the front legs between a support position extending from the seat cushion for attachment to the striker assembly and a retracted position lying against the seat cushion. The linkage assembly includes a first link member operatively coupled to the rear leg for controlling movement of the linkage assembly, a second link member extending between a first end operatively coupled to the first link member and an opposite second end, and a third link member having a first end operatively connected to the front leg and a second end operatively coupled to the second end of the second link member. A lost motion connection between the second and third link members automatically allows the front legs to be retracted from the support position to the retracted position in response to pivotal movement of the seat cushion from the seating position to the stowed position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0007] FIG. 1 is a schematic side view of an automotive vehicle seat assembly in a seating position;

[0008] FIG. 2 is a schematic side view of the seat assembly with the seat back in a folded position;

[0009] FIG. 3 is a schematic side view of the seat assembly in a stowed position recessed in a rear storage cavity within the vehicle floor;

[0010] FIG. 4 is a schematic side view of the seat assembly in a rearward facing tailgate position;

[0011] FIG. 5 is a partial side view showing the seat assembly including a linkage assembly in the seated position;

[0012] FIG. 6 is a partial side view showing the seat assembly including the linkage assembly in a vertically pivoted position;

[0013] FIG. 7 is a partial side view showing the seat assembly including the linkage assembly in the stowed position;

[0014] FIG. 8 is a perspective view of the linkage assembly of the present invention;

[0015] FIG. 9 is a partial side view showing an alternative embodiment of the seat assembly including a linkage assembly in the seated position;

[0016] FIG. 10 is an enlarged partial side view of the alternative embodiment of the seat assembly including a fourth link in the seated position;

[0017] FIG. 11 is an enlarged perspective view of the alternative embodiment showing the fourth link disposed about a front leg pivot;

[0018] FIG. 12 is a partial side view of the alternative embodiment showing the seat assembly in a vertically pivoted position with the linkage assembly fully extended;

[0019] FIG. 13 is a partial side view of the alternative embodiment showing the seat assembly in a vertically pivoted position with the linkage assembly fully retracted; and

[0020] FIG. 14 is a partial perspective view detailing the first and second rear pivot points of the linkage assembly of the alternative embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0021] A seat assembly for use in an automotive vehicle is generally shown at 10 in FIGS. 1-4. The vehicle is generally shown at 12 and includes a support floor 14 having a recessed storage cavity 16 formed in a rear portion thereof. The recessed storage cavity 16 includes vertical side walls (not shown) spaced apart by vertical front and rear walls 22, 24 that are interconnected by a lower floor portion 26.

[0022] The seat assembly 10 includes a seat cushion 32 and a seat back 34. The seat cushion 32 includes a cushion frame 36 and the seat back 34 includes a back frame (not shown). A recliner mechanism 40 is coupled to and between the cushion frame 36 and the back frame. The recliner mechanism 40 allows pivotal adjustment of the seat back 34 relative to the seat cushion 32 between a plurality of generally upright seating positions, as best shown in Figure 1, and a non-seating, forwardly folded position overlying the seat cushion 32, as shown in Figure 2. The recliner mechanism 40 may be any type as is commonly known to one skilled in the art. In the preferred embodiment of the invention, the recliner mechanism is of the type disclosed in Applicant's U.S. Patent No. 6,312,053, which is incorporated herein by reference in its entirety.

[0023] Again referring to Figures 1-4, the seat assembly 10 is shown in various positions within a vehicle 12. Figure 1 shows the seat assembly 10 having the seat back 34 and seat cushion 32 in a seating position, with the seat cushion 32 positioned generally horizontal relative to the floor 14 of the vehicle 12. Figure 2 shows the seat assembly 10 in a folded position with the seat back 34 folded forwardly overlying the seat cushion 32. Figure 3 shows the seat assembly 10 in a stowed position wherein the seat assembly 10 is disposed within the recessed cavity 16 formed in the floor 14 of the vehicle 12. And, Figure 4 shows the seat assembly 10 in a rearward facing tailgate position wherein the seat back 34 and seat cushion 32 positions are reversed relative to the seating position outlined above.

[0024] The seat assembly 10 includes front legs 52 that are removeably attached to strikers 54 (see Figure 5) attached to the floor 14 of the vehicle 12. The seat assembly 10 further includes pivot brackets 56 fixedly secured to the floor 14 of the vehicle 12 adjacent the storage cavity 16 and rear legs 58 pivotally coupled between the seat assembly 10 and pivot brackets 56. The rear legs 58 provide for pivotal movement of the seat assembly 10 to the stowed position, as shown in Figure 3 or to the rearward facing tailgate position, as shown in Figure 4. The pivot brackets 56 and rear legs 58 are further described and disclosed in Applicant's Published U.S. Application No. 2004/0026951, which is incorporated herein by reference in its entirety.

[0025] Referring to Figures 5-7, the front legs 54 include a first end 57 pivotally coupled to the seat cushion frame 36 by a pivot rod 114 for pivotal movement between a support position, extending from the seat cushion 32 to the floor 14 of the vehicle 12 for supporting the seat assembly 10 in the seating position, and a retracted position recessed against the bottom or underside of the seat cushion 32. The front legs 54 further include a second distal end 59 for carrying a latch mechanism (not shown) to latch the front legs 54 to the strikers 54 in the floor 14 of the vehicle 12 in the support position as is commonly known to one skilled

in the art. The rear legs 58 extend between a first end 61 pivotally coupled to the pivot bracket 56 by free pivot 150 and a second end 63 pivotally coupled to the seat cushion frame 36 by pivot rod 80 for moving the seat assembly 10 between each of the seating position, tailgate position and stowed position. A clock spring 154, as shown in Figure 14, is disposed about the pivot 80 and engagable between the rear legs 58 and seat cushion frame 36 for biasing the seat assembly 10 forward to the seating position. The rear legs 58 further include a stop pin 65 engagable with upper and lower recesses 67, 69 formed in the pivot bracket 56 for positioning and defining the seat assembly 10 in each of the seating and stowed positions, respectively. Referring to Figures 5-7, there is shown the seat cushion frame 36 and a linkage assembly 60 of the present invention in various positions relative to the floor 14 of the vehicle 12. Figure 5 shows the cushion frame 36 and linkage assembly 60 in the seating position corresponding to that of Figure 2. Figure 6 shows the cushion frame 36 and linkage assembly 60 pivoted about the pivot brackets 56 and in a vertical position relative to the floor 14 of the vehicle 12. Figure 7 shows the seat cushion frame 36 and linkage assembly 60 in the stowed position corresponding to the stowed position of Figure 3 within the recessed cavity 16 formed in the floor 14 of the vehicle 12.

[0026] Referring to Figure 8, the linkage assembly 60 includes a bell crank 68 comprising a cylindrical body 76 having a bore 78 formed along a center axis of the cylindrical body 76. The bore 78 allows the bell crank 68 to be rotatably mounted about the pivot rod 80 on the seat cushion frame 36. The bell crank 68 also includes two spaced apart arms 82, 83 extending radially from the cylindrical body 76.

[0027] The linkage assembly 60 preferably comprises multiple interconnected link members for retracting and extending the front legs 52 between the support and retracted positions in response to pivotal movement of the seat cushion 32. The multiple link members include a first link member 64 having a first end 66 pivotally connected to the pivot bracket 56 at pivot

71 and a second end 70 pivotally connected to the arm 82 of bell crank 68. The first link member 64 comprises a linear portion 72 extending from the first end 66 and terminating at an arcuate portion 74 at the second end 70. The arcuate portion 74 is shaped to allow for pivotal travel of the first link member 64 about the bell crank 68, as will be discussed in more detail below.

[0028] A second link member 84 includes a first end 86 pivotally connected to the arm 83 of the bell crank 68 and a second opposite end 90 slidably coupled with a third link member 88, as will be discussed in more detail below. The second link member 84 includes an arcuate portion 92 at the first end 86 for allowing travel and clearance about the bell crank 68, and a linear portion 96 extending towards the second end 90. A pair of pins 98 are attached to and project from the second link member 84 adjacent the second end 90 of the second link member 84.

[0029] The third link member 88 includes a first end 100 pivotally attached to the front leg 52 at pivot 101 and extends outward to a portion having a lost motion slot 62 formed therein. The lost motion slot 62 extends longitudinally between first 73 and second 75 ends and slidably receives the pins 98 of the second link member 84 therebetween defining a lost motion connection 104. The lost motion connection 104 allows the front legs 52 to retract to the stowed position relative to the seat cushion frame 36 when the seat cushion 32 is pivoted about the rear legs 58 from the seating position to the stowed position within the recessed cavity 16 in the floor 14.

[0030] A tension spring 106 includes a first end 108 attached to the third link member 88 and a second end 110 attached to the second link member 84. The tension spring 106 biases the front legs 52 to the stowed position relative to the seat cushion frame 56. The tension spring 106 also reduces vibrations and rattles associated with the linkage assembly 60.

[0031] In an alternative embodiment shown in Figures 9-14, the tension spring 106 is replaced with a torsion spring 112 positioned about the pivot 114 of the front legs 52. The torsion spring 112 biases the front legs 52 to the stowed position relative to the seat cushion frame 36, as well as reduces the vibrations associated with the linkage assembly 60.

[0032] Referring to the alternative embodiment shown in Figures 9-14, a fourth link member 116 is shown disposed about the front leg pivot 114. The fourth link 116 comprises a planar body 118 having a first through-bore 120 formed therein for mounting about the front leg pivot 114 and angularly spaced arms 117, 119 extending outwardly from the planar body 118. The arms 117, 119 engage a stop pin 121 attached to the front legs 52 and seated between the arms 117, 119 for pivoting the front legs 52 about the pivot 114. A pin 124 joins the third link member 88 to one arm 117 of the link fourth member 116. The fourth link member 116 produces a longer moment arm compared to the third link member 88 of the first embodiment; thereby increasing the mechanical advantage of the linkage assembly 60.

[0033] In the alternative embodiment, the third link member 88 includes an elongated slot 126 positioned proximate the first end 100 of the third link member 88 that receives the pin 124 joining the third and fourth link members 88, 116. The elongated slot 126 allows for variations in the position of the front legs 52 in relation to the strikers 54 in the floor 14, assuring secure attachment of the front legs 52 with the strikers 54 when the seat assembly 10 is in the seating position. The third link member 88 also includes an extension spring 128 having a first end 130 attached to the pin 124 and a second end 134 attached to a spring slot 132 formed in the third link member 88. The extension spring 128 positions the pin 124 within the elongated slot 126, and allows for adjustment of the front legs 52 relative to the striker 54.

[0034] In operation, the seat assembly 10 can be moved from the seating position, shown in Figure 1, to a position where the seat back 34 is collapsed or folded down on the seat cushion

32, as shown in Figure 2, by actuating the recliner mechanism 40. The front legs 52 can then be released from the strikers 54 by a release mechanism, as is commonly known in the art. Once the front legs 52 are released from the strikers 54, the seat assembly 10 may be moved to the stowed position, shown in Figure 3, by moving the seat cushion 32 about the rear legs 58 attached to the pivot brackets 56. Alternatively, the seat back 34 may be maintained in the seating position, and the front legs 52 released from the strikers 54 to move the seat assembly 10 to the tailgating position shown in Figure 4.

[0035] When the front legs 52 are released from the strikers 54, the tension spring 106 or torsion spring 112 of the first and alternative embodiments, urges the front legs 52 to pivot about the front leg pivot point 114 to the stowed position relative to the seat cushion frame 36. As the seat cushion 32 is raised, the seat cushion frame 36 pivots about the first rear pivot 150 at the connection of the rear legs 58 and pivot brackets 56. The second rear pivot is provided by the connection of the pivot rod 80 between the seat cushion frame 36 and rear legs 58. The clock spring 154 disposed about the pivot rod 80 ensures selective pivoting about the first rear pivot 150 at the outset of motion of the seat cushion 32, as opposed to the pivot rod 80. The first link member 64, attached to the pivot brackets 56 and bell crank 68, causes counter-clockwise rotation of the bell crank 68 in response to pivotal movement of the seat cushion 32. The second link member 84, also connected to the bell crank 68, rotates counter-clockwise as well, causing the pins 98 of the second link member 84 to move or slide rearward in the lost motion slot 62 formed in the third link member 88. This arrangement allows the front legs 52 to be retracted, before complete pivoting of the seat cushion 32 to the stowed position in Figure 3, as the lost motion slot 62 allows continued travel of the linkage assembly 60 without binding.

[0036] Continued rotation of the seat cushion 32 about the first rear pivot 150 continues until the rear legs 58 intersect the pivot brackets 56 and the stop 65engages the recess 69 in a stop

position, shown in Figure 6. At this stop position, the front legs 52 are retracted and stowed relative to the seat cushion frame 36 due to the assist springs 106, 112, as well as the force of gravity on the front legs 52 as the seat cushion 32 is tilted about the rear legs 58.

[0037] Continued movement of the seat cushion 32 causes pivoting of the seat cushion frame 36 about the pivot rod 80 against the bias of the clock spring 154 due to the inability to pivot about the first rear pivot 150, as shown in Figures 6 and 7. The continued rotation of the seat cushion frame 36 causes the second link 84 to nest about the bell crank 68, as shown in Figure 7. Additionally, there is continued movement of the pins 98 in the lost motion slot 62 of the third link 88, until the seat assembly 10 is in the stowed position within the recessed cavity 16. When in the stowed position, the front legs 52 can be moved by an occupant of the vehicle towards the extended support position against the biasing force of the springs 106, 112, without damaging the linkage assembly 60.

[0038] In the alternative embodiment, the fourth link member 116 pivots about the front leg pivot 114 in response to movement of the third link's 88 movement, as shown in Figure 13. The fourth link member 116 moves without engaging the stop 121 disposed on the front legs 52 until the front legs 52 are moved to the retracted or stowed position relative to the cushion frame 36. As with the first embodiment, the assist spring 112 and force of gravity urges the front legs 52 to the stowed position relative to the seat cushion frame 36.

[0039] When the seat assembly 10 is returned from the stowed position to the seating position, a reverse of the above-described events occurs. First the seat cushion 32 pivots about the pivot rod 80, and then the first rear pivot 150 towards the seating position. The pins 98 of the second link 84 move forward in the lost motion slot 62 until they contact the end of the lost motion slot 62; thereby urging the front legs 52 into positive position to engage the strikers 54. In the first embodiment, the third link 88 is connected to the front leg 52, such that engagement of the pins 98 with the end of the slot 62 cause the front legs 52 to move

from the retracted or stowed position relative to the seat cushion frame 36 to the support position. In the alternative embodiment, the fourth link member 116 pivots about the front leg pivot 114 from the position in Figure 13 to the position in Figure 12, where one of the arms 119 of the fourth link 116 engages the stop 121 of the front leg 52 causing the front leg 52 to move from the stowed position relative to the cushion frame 36 to the seating position.

[0040] In the alternative embodiment, the third link 88 is connected to the fourth link 116 by the pin 124 for moving the front legs 52 towards the support position and engagement with the strikers 54. To ensure engagement with the strikers 54, the third link member 88 includes an elongated slot 126 positioned proximate the first end 100 of the third link member 88 that receives the pin 124 joining the third and fourth link members 88, 116. The pin 124 is positioned within the elongated slot 126 by the extension spring 128 allowing for variations in the position of the front legs 52 with respect to the strikers 54.

[0041] Therefore, the pins 98 of the second link member 84 disposed in the lost motion slot 62, position the front legs 52 when moving from the stowed position to the seating position, but travel without contacting an end of the lost motion slot 62 when the seat assembly 10 is moved from the seating to the stowed position.

[0042] The invention has been described in an illustrative manner, and it is to be understood that the terminology, which has been used, is intended to be in the nature of words of description rather than of limitation.

[0043] Many modification and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced other than as specifically described.